national accelerator laboratory

EXP-44
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ACCELERATOR EXPERIMENT--Main Ring Injection Studies

Experimentalists: R. L. Cassel and R. F. Stiening

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In a previous experiment (EXP-43), we showed that the widths of the betatron resonance stop bands in the Main Ring were strongly affected by the manner in which the Main Ring magnets were de-excited from high energy. The purpose of this experiment was to separate the effects of quadrupoles and bending magnets by controlling the de-excitation of these magnets separately.

For both parts of this experiment, the bending magnet de-excitation was held to a "coast down" program with negligible undershoot. Two quadrupole programs were studied: a coast down and an undershoot. In the undershoot case, the quadrupole current fell 38 amps below the normal injection level of 92.5 amps for 100 ms before recovering to the normal level. Because the quadrupole power supply reference is a coil in a bending magnet, the quadrupole current had to be adjusted empirically to give the same tune for both de-excitation programs. The currents for constant tune are as follows:

Undershoot: 92.625 amps
Coast Down: 91.625 amps.

These data imply that in the undershoot case, the remanent gradient is approximately 25% lower than in the coast down case. If fluctuations in quadrupole remanent fields were dominant in driving betratron resonances, these two cases should be considerably different.

In Figures 1a and 1b, we show the 0.3 second transmission of the 8 GeV beam as a function of quadrupole current. The data are identical. Thus it can be concluded that the Main Ring

bending magnets are the source of the driving terms for the important betatron resonances. This result is supported by data supplied by C. Schmidt on the remanent field of quadrupole #7.033. These data show that the remanent field itself is a quadrupole with a gradient of 2 G/cm. This is to be compared with the case of the bending magnets where the remanent field has a strong sextupole component.

Summary

It is found that the de-excitation program of the Main Ring quadrupoles does not significantly affect the principal betatron resonance stop bands.

R. F. Stiening

RFS:csn

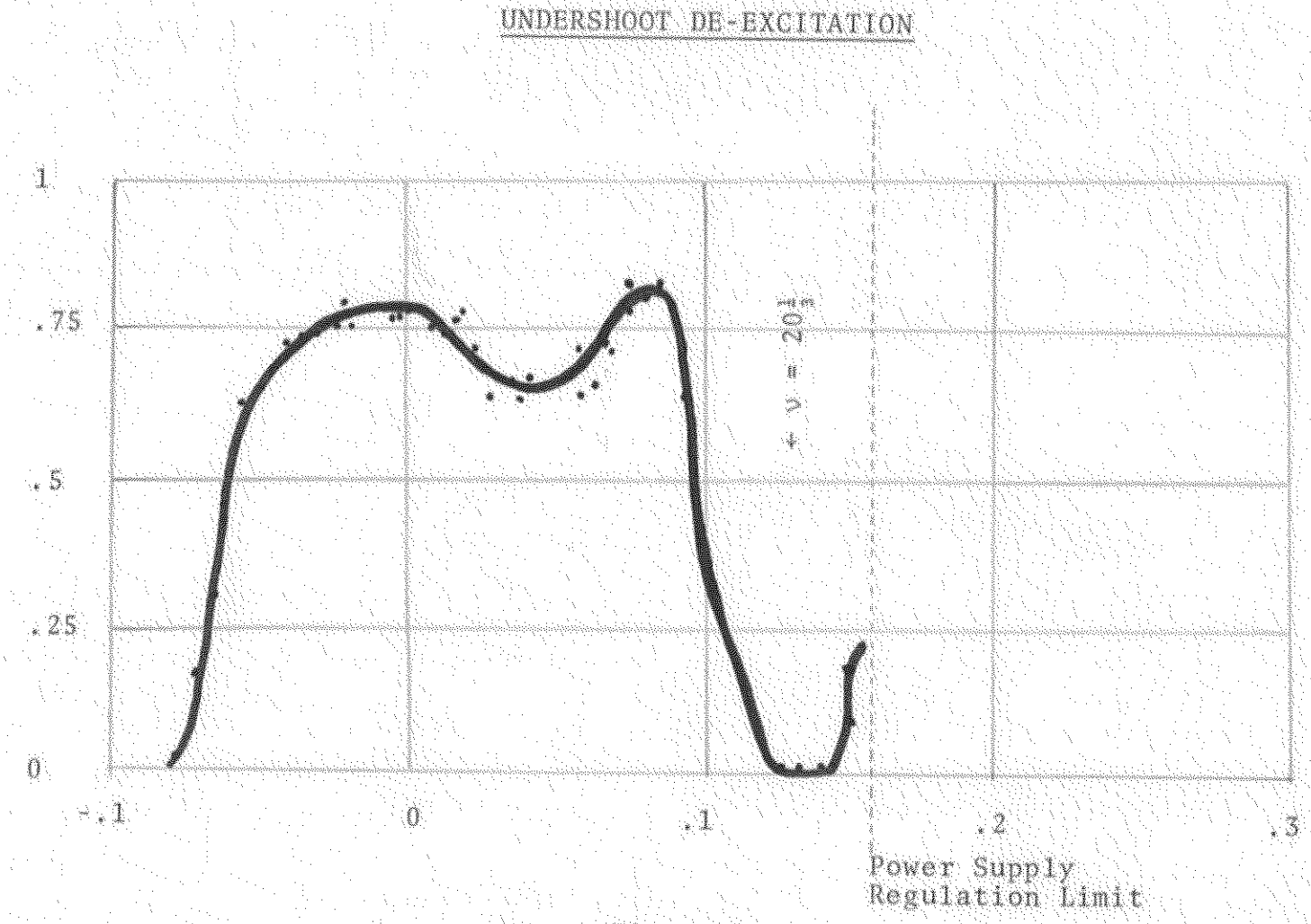

Figure 1a.
Tune Change

COAST DOWN DE-EXCITATION

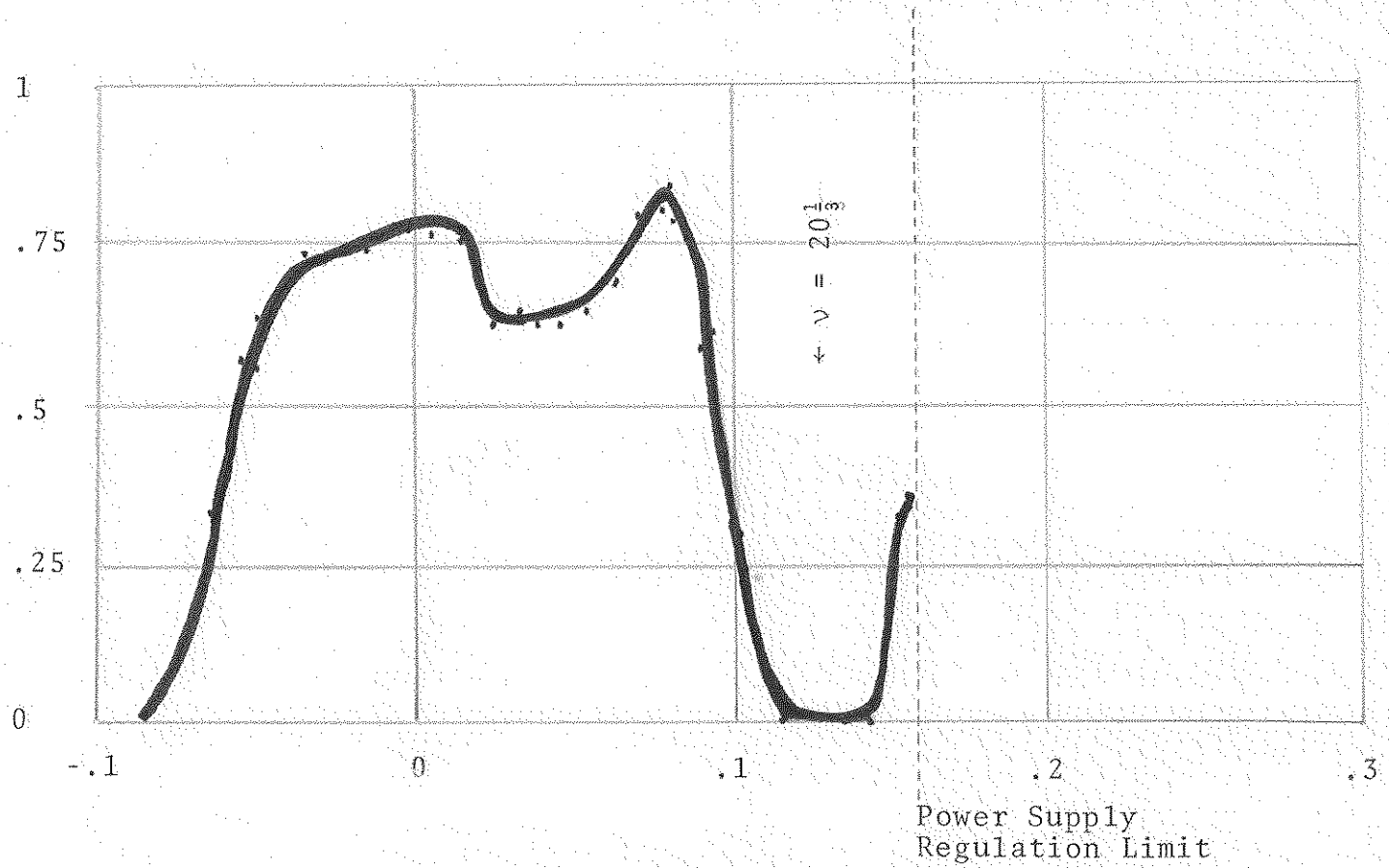

Figure 1b.
Tune Change